Biology and fishery of *Pseudosciaena sina* (C.) at Ratnagiri, South Maharashtra[1]

B. V. Bhusari[2]

(*With five text-figures*)

Sciaenids constitute 3 per cent of the total marine catch in India contributing nearly 26,000 m tonnes per annum (on average for 10 years). In Maharashtra the percentage of sciaenids is 4.6 per cent (9,111 m tonnes) (on average for 10 years) per annum on total marine catch and 35 per cent of the total sciaenid catch of India.

Ratnagiri is an important fishing centre in southern Maharashtra and sciaenids contribute nearly 22 per cent of the total trawl catch. Fourteen species of sciaenids have been recorded, and among these *Pseudosciaena sina* predominates, contributing nearly 38.5 per cent to the total trawl catch.

Material and methods

Fishes required for the purpose of this study were collected regularly from the trawl catches landed at Ratnagiri. The trawlers operate in an area (arc) about 20 miles north and south of Ratnagiri and land their catches at different landing centres in Ratnagiri, i.e. Kalbadevi, Mirkarwada and Rajiwada. As the trawling and shore seine operations are suspended during the monsoon season specimens were obtained from the catches of cast nets and hook and line, brought to Ratnagiri fish market. In all 600 specimens were measured to the nearest millimetre and weighed to the nearest gramme. For the study of food and feeding habits the specimens were cut open and measurements of the component parts of the alimentary canal were taken. The relative length of intestine (RLI) and relative length of the gut (RLG) were noted. Qualitative analysis of food was done in both adults and juveniles whereas the quantitative analysis of food items was done by displacement method for the adults only.

---

[1] Accepted June 1973.

[2] Taraporevala Marine Biological Research Station, Bombay 400 002.

For determining the minimum size of maturity in the female fifty specimens were examined. As the sexes cannot be distinguished in sizes below 7 cm, fishes of 8 cm and above only were examined for the different maturity stages in females. The colour of the ovary and its extension in the body cavity were taken into consideration for measurements of ova diameter. Ovaries were preserved in 5 per cent formalin for 8-10 days. About 700 ova were measured from each ovary. The ova were separated by testing out a portion of the posterior region of the ovary on a glass slide and were measured by means of eyepiece micrometer.

Ova measuring less than 5 md (1 md = 0.03 mm) were not considered as these were present in the ovaries in all stages of maturity (De Jong 1939, Clark 1934). Fecundity was estimated by weighing one gram sample of the ovary and counting the number of eggs contained in it. The number of eggs in the ovary was computed by taking into consideration the total weight of the ovary. The maturity scale adapted by ICES (Wood 1930) was followed for studying the progression of ova towards maturity. The spawning in this species was determined by studying the different stages of the ovary occurring in each month. The percentage of occurrence of males and females was observed for the sex ratio.

The fishery of the species was estimated from random samples of *c* 10 kg once every ten days for analysis. For studying the length frequency distribution, 1500 specimens were measured within a period of 3 months.

Food and feeding habits

Earlier works [Gopinath (1942), Mookerjee *et al.* (1946), Chacko (1949), Kow (1950), Jacob (1948) and Rao (1964)] indicate that adult sciaenids consume a variety of food consisting mainly of crustaceans, fishes, molluscs, polychaetes and echinoderms and are thus carnivorous and benthic. During this investigation it was found that juveniles ranging in total length from 5.6 to 7 cm mainly feed on planktonic copepods, *Lucifer*, *Mysis*, *Acetes*, small prawns and polychaetae larvae.

The following items of food were seen in the gut contents of *Pseudosciaena sina*—

1) Teleosts — Sole fish, *Leognathus* sp., young of sciaenids.
2) Crustaceans — *Penaeus* sp., *Metapenaeus* sp., crustacean larvae, crabs, *Mysis*, *Squilla*, hermit crabs and Amphipods.
3) Echinoderms — Sea urchins.
4) Polychaetes — Nereid worms.
5) Molluscs — Bivalves.

Fluctuations in the composition of the main food items consumed by adults of *Pseudosciaena sina* in different months are shown in table 1.

It will be seen from table 1 that crustaceans form the most do-

TABLE 1

PERCENTAGE COMPOSITION OF IMPORTANT FOOD ITEMS DURING DIFFERENT MONTHS IN THE YEAR AUGUST 1962 TO JULY 1963 IN *Pseudosciaena sina*

Months	No. of specimens examined	Fishes	Prawns	*Squilla*	*Acetes*	Other crusta-ceans	Total crusta-ceans	Salps	Poly-chaetes	Molluscs	Misc.
1. August 1962	60	6.95	48.10	—	41.87	3.12	93.09	—	—	—	—
2. September	86	6.70	30.02	3.63	18.55	40.18	92.38	—	—	0.92	—
3. October	33	15.62	56.25	12.50	7.80	3.12	79.65	—	—	—	4.68
4. November	31	33.35	27.87	36.36	2.42	—	66.65	—	—	—	—
5. December	44	28.55	23.27	49.87	—	—	73.14	—	—	—	—
6. January 1963	29	26.66	36.65	33.32	—	—	69.97	3.33	—	—	—
7. February	29	70.00	30.00	—	—	—	30.00	—	—	—	—
8. March	72	5.55	18.03	65.21	—	1.38	84.61	6.93	—	2.76	—
9. April	23	—	8.16	86.00	—	—	94.16	—	—	6.00	—
10. May	35	3.93	35.43	3.93	25.19	—	64.05	—	—	—	31.49
11. June	17	7.40	25.90	25.90	40.70	—	92.50	—	—	—	—
12. July	24	17.77	17.77	17.77	13.33	33.30	82.17	—	—	—	—

minant group as its food. Among crustaceans, prawns, *Squilla, Acetes* are the most common items.

Prawns: Prawns are taken practically throughout the year. The percentage of prawns as food in the gut contents varies from 8.16 to 56.25. The average percentage of prawns in August, September and October was 45. The percentage of prawns during these three months in the fishery is also high and its average percentage is 70 during this period.

Squilla: *Squilla* in the food was observed during whole year except in the months of August and February. The percentage of *Squilla* in the food was observed to be more in the month of December (50%), March (65%) and was maximum in the month of April (86%).

Fish: This is the third important item. Fish as food was observed throughout the year with maximum in February (70%) and minimum in May (3.93%). The average percentage of fish in food in the months of November, December, January and February was 40.

Acetes: *Acetes* was commonly observed from May to November in food. Maximum percentage was in June (41%) and August (42%) whereas it was minimum in November (2.42%).

The absence of *Acetes* in food from December to April in spite of their presence in the locality and availability indicates that the fish prefers prawns, *Squilla* and fish. The presence of benthic animals like prawns, *Squilla,* molluscs, crabs in the gut contents indicates its bottom feeding habits.

Maturation and Spawning

Description of the ovary

Until the fish attains 7 cm in total length it is difficult to distinguish females from males. The gonads in both the sexes are thread-like and whitish in colour. The ovaries in specimens over 7 cm appear slightly swollen compared to testes of corresponding size. Different stages of ovarian maturity as determined from external appearance of the ovary and its extension in relation to the body are given below:

1) Immature Ovary — The ovary is transparent with reddish appearance and extends to about $\frac{1}{2}$ of the body cavity.
2) Maturing Ovary — The ovary is yellowish in colour. The ova are granular in nature and are also visible to the naked eye. The ovary extends to nearly $\frac{3}{4}$ of body cavity.
3) Mature Ovary — The ovary is similar in appearance to the maturing ovary but is more swollen and extends the entire length of the body cavity.
4) Ripe Ovary — The ovary at this stage is fully swollen occupying the entire body cavity. Ova are transparent.

5) Spent Ovary — The ovary is flaccid, blood-shot and wrinkled and extends $\frac{1}{2}$ of the body cavity or more.

Size at first maturity

To study the minimum size of maturity in the females a number of specimens were examined. As already stated sexes are not clearly distinguishable below 7 cm and, as such specimens ranging from 8 to 14 cm were only considered. From the data plotted in Fig. 1, it will be seen that 15 per cent of the fish matured in the 11.2 cm groups, and 48 per cent in the 12.5 cm groups. Nearly 50 per cent of the females of *Pseudosciaena sina* reached first maturity at a length of 11.2 to 12.5 cm. This is, therefore, considered as the minimum size of first maturity. The fishes measuring 13 cm and above were 100 per cent mature.

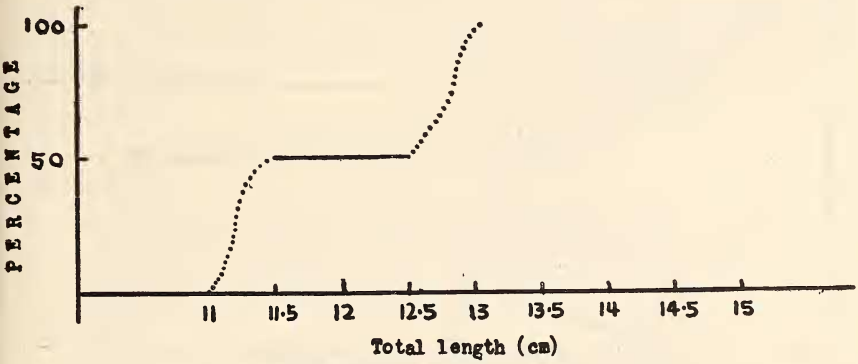

Fig. 1. Size at first maturity in *Pseudosciaena sina.*

Development of Ova

An ovary in advanced maturity was selected for studying the maturation stages of the ova. A sample of ova from this ovary was taken and ova diameter measurements were made. The ova were classified in micrometer division groups and a percentage frequency polygon was drawn.

First batch

Ova ranging in size from 0 to 5 m d. in diameter. The ova are transparent and the nucleus is clearly visible. Such ova are present throughout the year and represent the general stock of eggs.

Second batch

Diameter 6 to 10 m.d. These ova are also transparent with nucleus and protoplasmic layer visible.

Third batch

Diameter 11 to 15 m d. Ova granular and yellow in colour and with yolk.

Fourth batch

Diameter 16 to 20 m d. Ova granular, round, and yellow in colour.

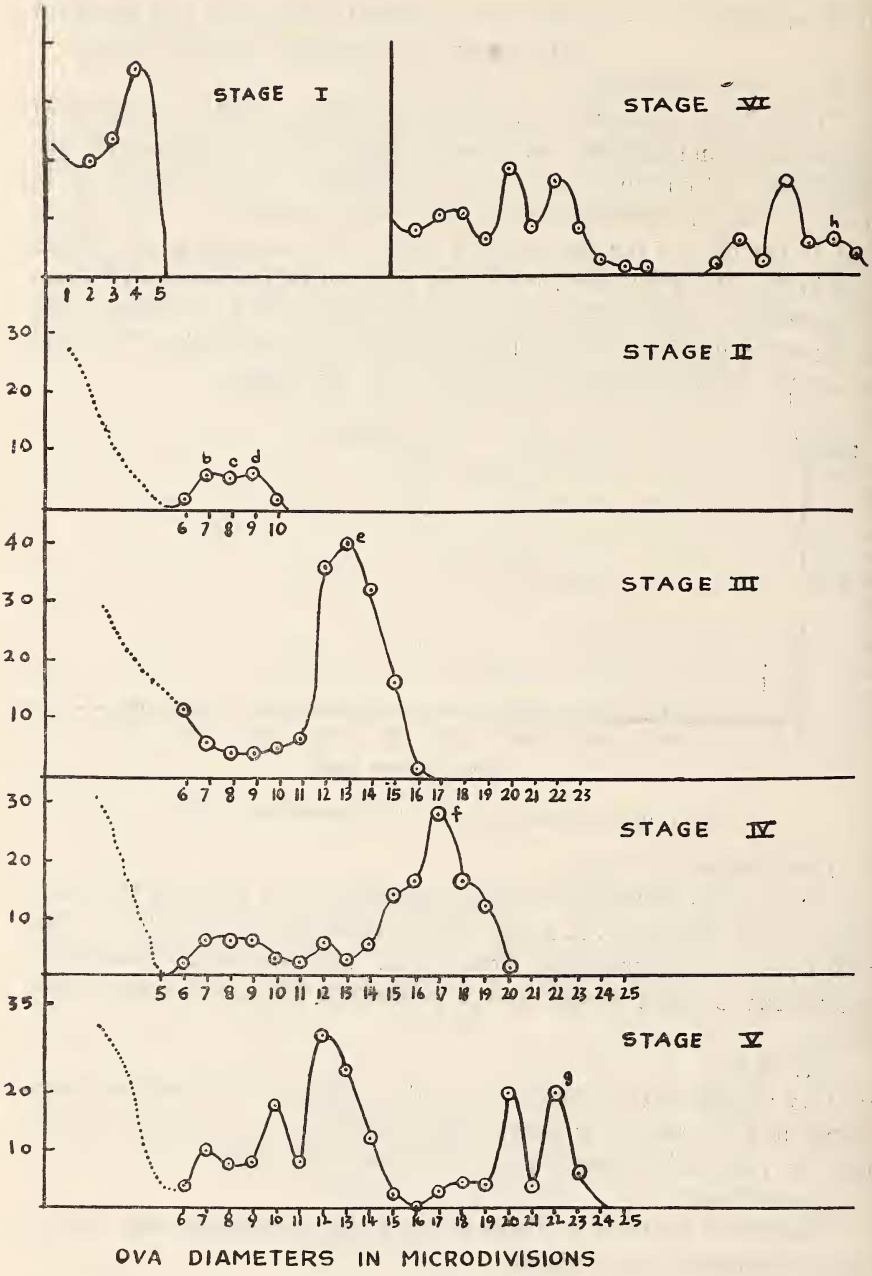

Fig. 2. Different stages of Maturation in *Pseudosciaena sina.*

Fifth batch

Diameter 21 to 25 m d. Ova round and transparent with a single oil globule. This is perhaps the spawning stage of the ovary.

To determine the growth of the ovary from immature to spent stage, it is necessary to arrange the data in chronological order starting from the month in which immature ovaries are observed until the period when spent ovaries occur.

However, when the observations on the condition of the ovary were undertaken, it was found that fish in different stages of maturity occurred in any sample indicating that all the fish do not mature simultaneously. It was, therefore, decided to group the data on the basis of largest mode in diameter frequency percentage of ova.

Accordingly, a number of fishes in different stages of maturity were selected and ova diameter measurements were made. They are represented by frequency polygins (Fig. 2). In all 10 stages of maturity were encountered. They are:

1) *Immature*
   - i) Stage "a" frequencies with a mode at 3 m d.
   - ii) Stage "b" frequencies with a mode at 5 m d.

2) *Maturing*
   - iii) Stage "c" frequencies with a last mode at 7 m d.
   - iv) Stage "d" frequencies with a last mode at 10 m d.
   - v) Stage "e" frequencies with a last mode at 12 m d.
   - vi) Stage "f" frequencies with a last mode at 15 m d.

3) *Mature*
   - vii) Stage "g" frequencies with a last mode at 17 m d.
   - viii) Stage "h" frequencies with a last mode at 20 m d.

4) *Ripe*
   - ix) Stage "i" frequencies with a last mode at 25 m d.

5) *Spent*
   - x) Stage "j" frequencies with a last mode at 5 m d.

More than seven stages of maturity could be described in *Pseudosciaena sina* but as per standards of the International Council of exploration of Sea (Wood 1930) the stages examined are:

Stages in *Pseudosciaena sina*	Ova diameter range in m d.	Stages described by I.C.E.S.
Stage "a" & "b"	0 to 5	I
Stage "c" & "d"	5 to 10	II
Stage "e" & "f"	10 to 15	III
Stage "g"	15 to 17	IV
Stage "h"	17 to 20	V
Stage "i"	20 to 25	VI (Spawning)
Stage "j"	Less than 6	VII (Spent)

Fishes with ovaries in all these stages of maturity were observed nearly throughout the year.

However, to study the spawning season, the data from 400 specimens were converted into frequency percentage of stages of maturity for each month (Fig. 3).

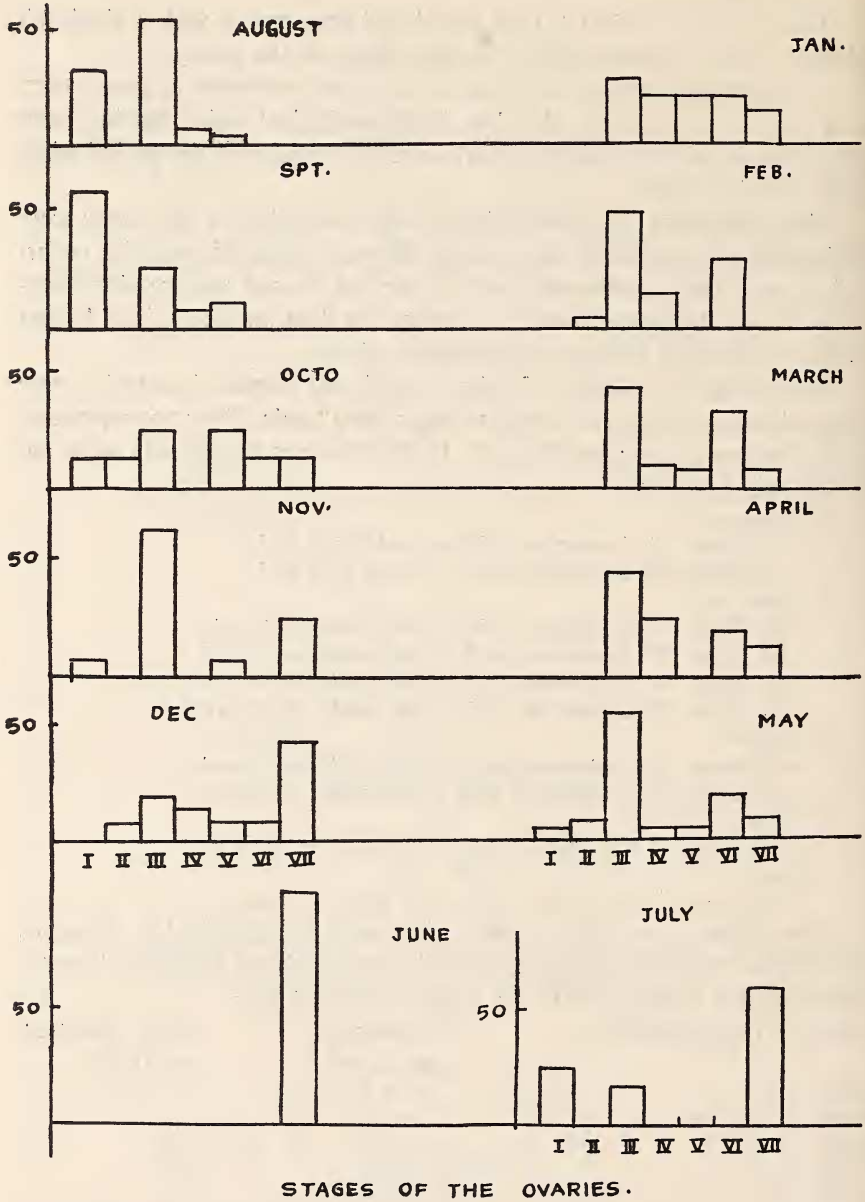

Fig. 3. Percentages of different stages of maturity in *Pseudosciaena sina* in different months.

From the histograms it is seen that fishes in stages III, IV and V of maturity are very common, forming 50 to 80 per cent. During the study period few fishes in stage VI of maturity were observed.

There is no information on the eggs and larvae of *Pseudosciaena sina*. Attempts to collect these were also not successful. In the absence of any information on eggs and larvae it is difficult to fix up a definite spawning period. The fishes in stages IV and VI of maturity are available from October to May, and fish in spent condition (VII stage) from October to July. Nearly 85 per cent spent ovaries were encountered in the months of June and July.

Frequency of spawning

The multiplicity of modes in the ova diameter frequency curves shows that the size range of ova is large and there is a continuous gradation, indicating several batches of eggs in all stages of maturity. Thus, it appears that the production and withdrawal of eggs is a continuous process and the species spawns more than once over a greater part of the year. The presence of fish in advance states of maturity IV, V, VI and spent individuals over a greater part of the year seems to corraborate this inference. The availability of these fishes in large quantities in trawl catches at Ratnagiri also supports the above findings.

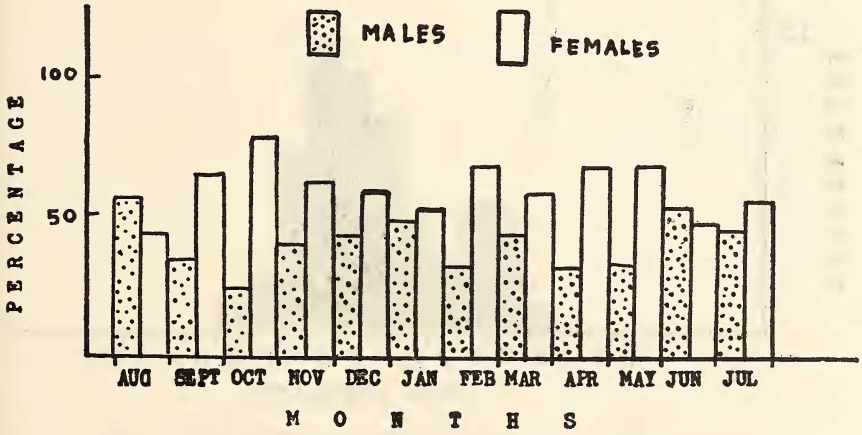

Fig. 4. Percentage of occurrence of Males and Females.

Fecundity

The ova count of this species shows that ova produced by individuals of the same length showed variation. The fecundity varies between 32,174 to 60,840 eggs.

	Weight of the ovary in gm	No. of eggs
i)	9.420	60,840
ii)	6.900	47,140
iii)	5.530	46,610
iv)	4.640	40,620
v)	2.550	32,174

Since specimens of the same length show variation, it is probable that there is a prolonged spawning period, and that the spawning is intermittent and that the eggs are spawned in batches.

Sex Ratio

From Fig. 4 it is evident that the female of *Pseudosciaena sina* predominates in the commercial catches throughout the year.

Fishery

As already stated, the trawl catch landings of sciaenids, the *Otolithus* and *Pseudosciaena sina* together contribute nearly 83 per cent of the total sciaenid catch at Ratnagiri. To analyse the length frequency distribution 1,500 specimens were measured at random for a period of three months, i.e. October, November and December, when fishing season is in full swing at Ratnagiri. The catch analysis shows (Fig. 5)

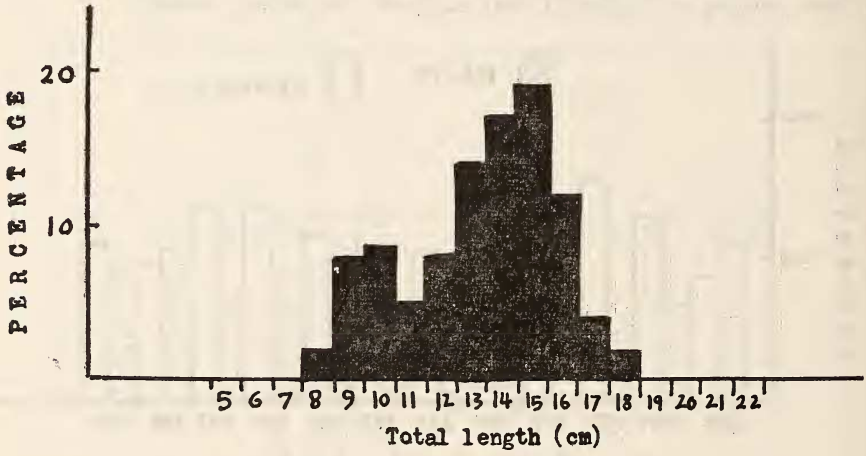

Fig. 5. Length frequency distribution in *Pseudosciaena sina.*

that fishes ranging in size from 12-13 cm in total length are most common and dominant in the trawl catches and form the major group in the fishery at Ratnagiri . It has been observed that these fish mature for the first time at this length and are caught in trawl without giving any chance to spawn even for the first time; probably this is detrimental to the sustained yield of sciaenid fishery. Attention should be drawn to the fact that the catches of sciaenids have been going down during the last ten years. Vellappan Nair *et al.* (1969) found the average annual landing of sciaenid catches in India to be 36,320 M. tonnes (1950-1962)

whereas the 1962-1971, average is 26,000 M. tonnes and that of Maharashtra 13,570 M. tonnes (1960-62) and 9,111 M. tonnes (1962-71).

Acknowledgements

I am grateful to Dr. C. V. Kulkarni, former Director of Fisheries, Maharashtra State, Bombay, for constant guidance and encouragement throughout this work. Thanks are due to Dr. A. R. Longhurst, Director, Marine Environmental Research, Plymouth, United Kingdom, for kindly going through this paper and making valuable suggestions. I am thankful to Dr. H. G. Kewalramani, Specialist (Fisheries), National Commission on Agriculture, Delhi, and Dr. M. R. Ranade, Senior Scientific Officer, Marine Biological Research Station, Ratnagiri, for kindly going through the manuscript and for helpful suggestions.